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ICE-CUBE MAKING MACHINE AND ART OF EJECTING THE CONTENTS OF RECEPTACLES

Filed June 3, 1944

3 Sheets-Sheet 1

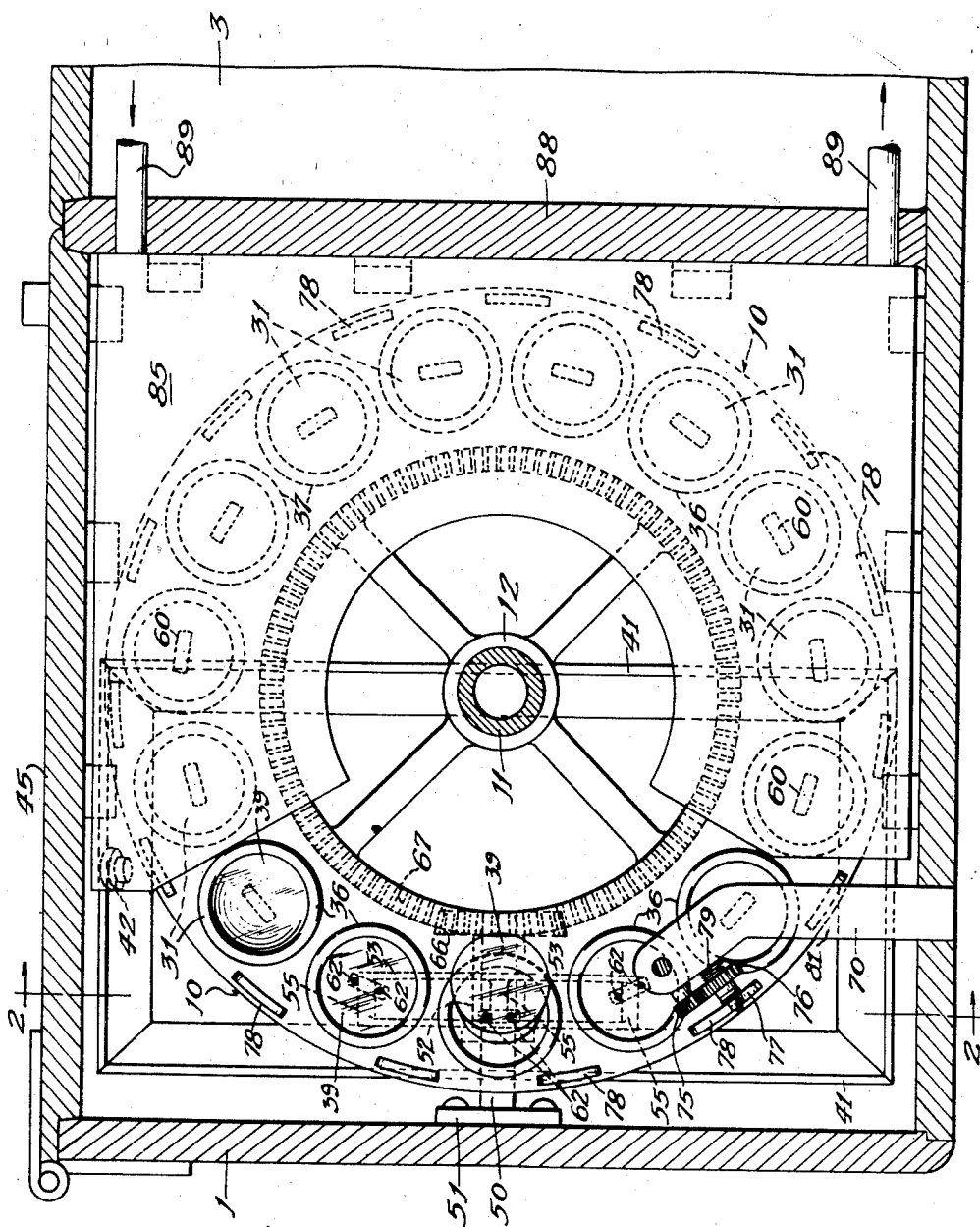


Fig. 1.

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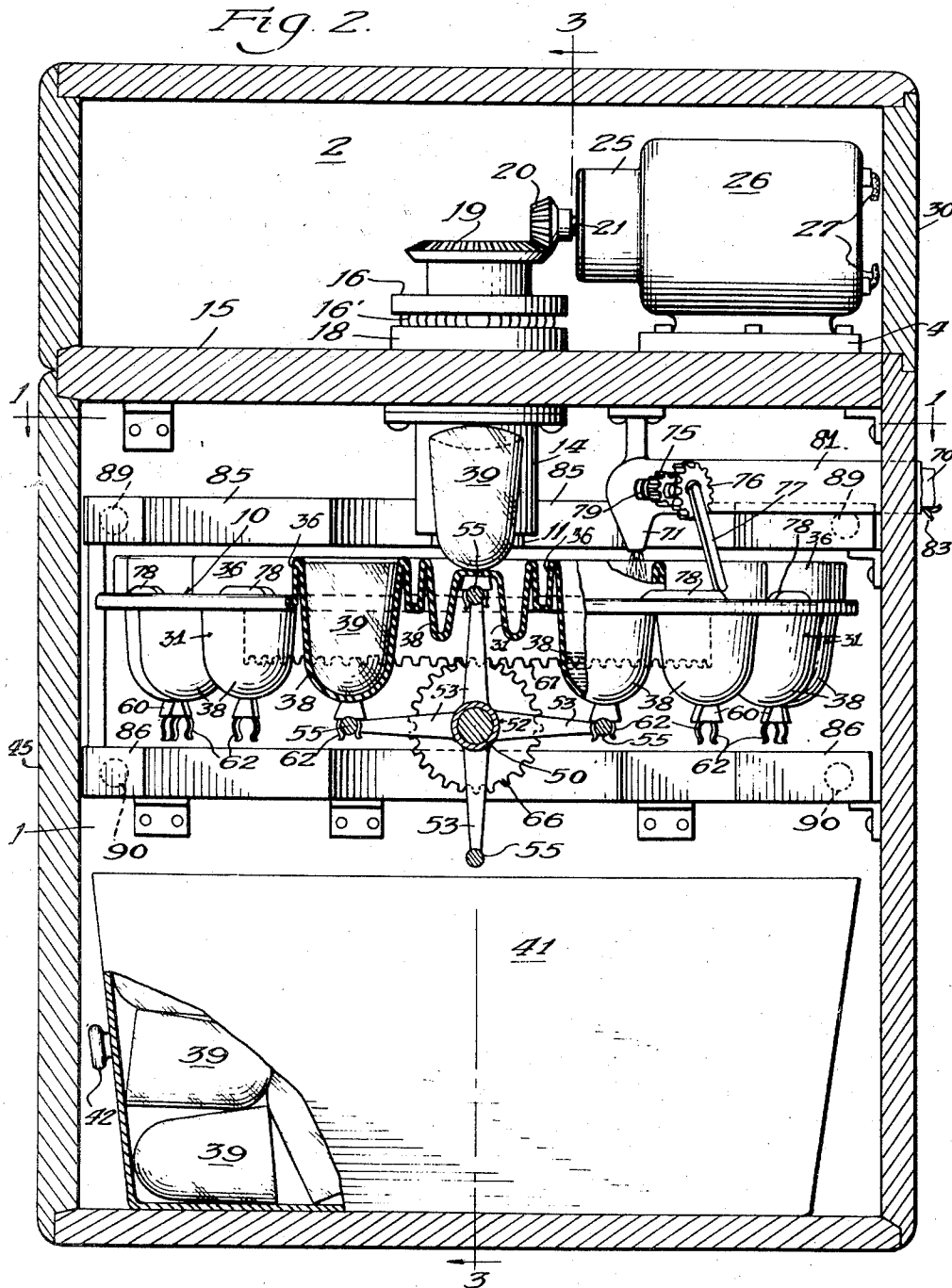
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Fig. 2.



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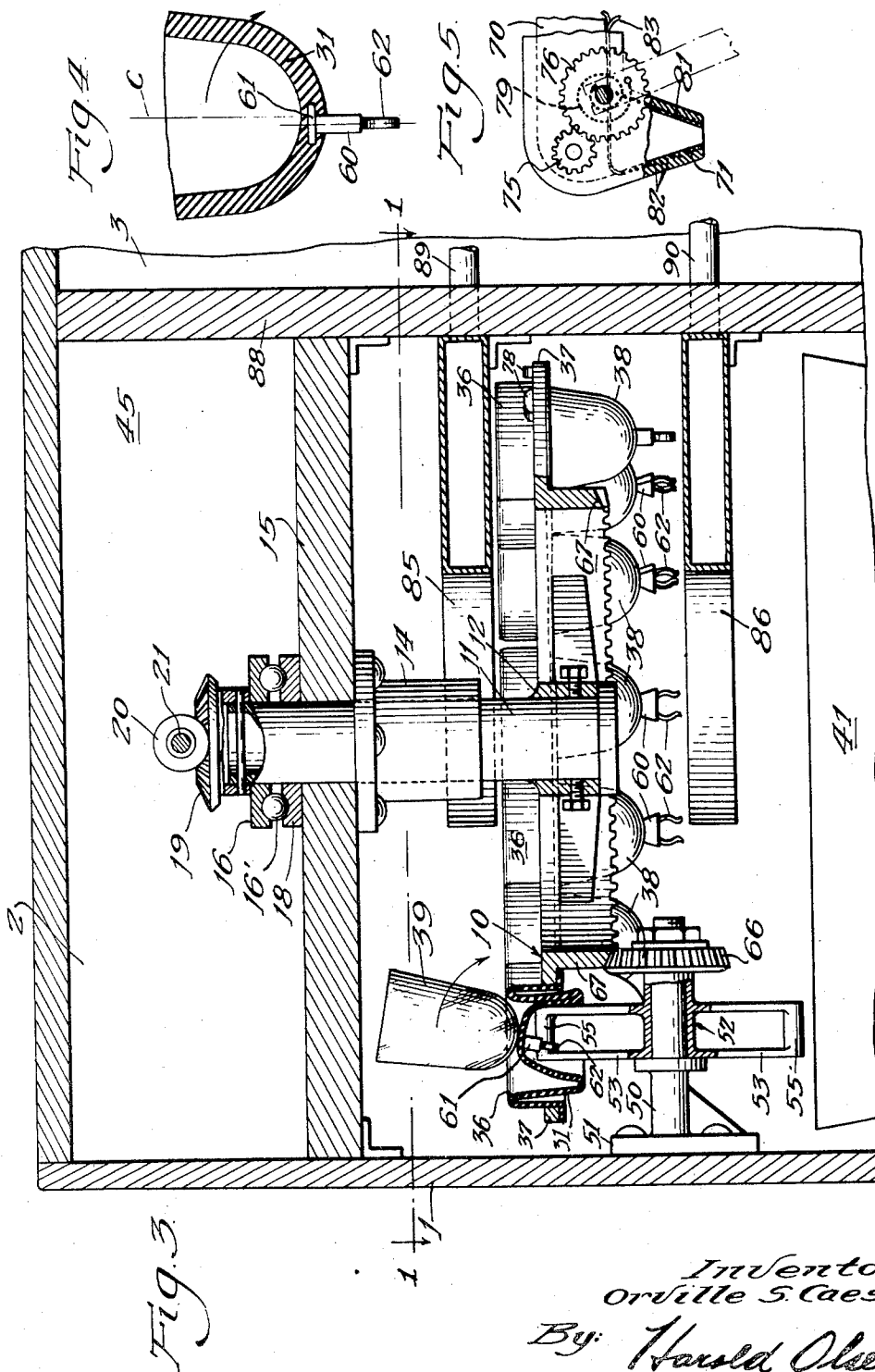
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UNITED STATES PATENT OFFICE

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ICE-CUBE MAKING MACHINE AND ART OF EJECTING THE CONTENTS OF RECEPTACLES

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20 Claims.

(Cl. 62-106)

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This invention relates to improvements in ice-cube manufacturing devices, and generally to the art of ejecting the congealed contents of receptacles.

An important feature is the production of a compact and relatively cheap device for the domestic or household production of ice cubes. Hereofore, insofar as I am aware, no one has so simplified the construction of an ice-cube making apparatus that it could be built cheaply enough to be sold as a small unit for domestic use. The principle herein may also be generally applied to the ejection of the congealed and/or frozen contents of receptacles having portions which are adapted for movement for that purpose.

Features of the invention include: The ejecting mechanism per se; the art of ejecting in the manner set forth; the suspension of the receptacle carrier from a support above it; the driving of the cup-emptying mechanism from the receptacle carrier; the use of flexible rubber for the cups; the use of any kind of receptacle which has a part adapted for movement to eject its contents; the use of clips and cylinders as part of the cup-emptying mechanism; the use of a continuously coupled connection acting forcibly on the cup in two opposite directions; the use of spring clips and their attachment by embedment in the cups; all details of construction; and all broad ideas of means inherent in the disclosure.

Objects, features and advantages of the invention will be set forth in the description of the drawings, and in said drawings—

Fig. 1 is a plan section taken approximately on line 1-1 of Fig. 2;

Fig. 2 is a vertical section taken approximately on line 2-2 of Fig. 1;

Fig. 3 is a vertical section taken approximately on line 3-3 of Fig. 2;

Fig. 4 is an enlarged detail section through the bottom part of one of the pockets showing how the clip-carrying device is embedded; and

Fig. 5 is a detail side elevation partly in section of the nozzle end of the water-supply means.

My improved mechanism is herein applied in an ice-cube making machine, but its principle of operation may have other uses.

The drawings illustrate an embodiment which is adapted for the domestic production of ice cubes. The improved structure is enclosed in a suitable insulated casing, which includes a freezing and storage chamber 1, a motor chamber 2, and a chamber 3 adapted to house a suitable refrigerating mechanism (not shown) but con-

nected with a freezing unit later to be described.

Within the freezing and storage chamber is disposed a horizontal ring-like carrier generally designated 10. The ring is attached by arms to a hub, and the carrier structure is suspended for rotation about a vertical axis by means of a hollow shaft 11 detachably secured as by screws to the hub 12 of the carrier. The shaft passing upwardly through a bearing 14 is attached to a horizontal partition 15 which forms the ceiling for the chamber and the floor of the upper or motor chamber 2.

The shaft is supported by a ball bearing structure including an upper member 16 which is secured to and moves with the shaft, a lower member 18 secured to the floor 15, and balls 16'.

Above the bearing there is pinned to the shaft a beveled gear 19 meshing with a companion gear 20 secured to a shaft 21, which shaft is connected through suitable reduction gearing (not shown) contained in a casing 25 attached to the casing of an electric motor 26. Suitable power leads for the motor are shown at 27. An entrance door for the chamber 2 is shown at 30. The carrier is preferably driven slowly under control of the reduction gearing in the casing 25.

On the ring of the carrier 10 is a circular row of similar pockets 31 as receptacles for receiving water to be frozen. In Figs. 2 and 3 one of the pockets is shown in section and in discharging position. In Fig. 2 three of the pockets are shown in section. Reading from left to right, the first pocket has a frozen ice cube therein ready to be discharged, in the second a formed cube is being discharged, and the third is shown as being filled with liquid to be frozen.

Each cup 31 has a movable portion which when properly moved is capable of causing discharge of a formed cube. In this instance each cup is made of flexible material, preferably of rubber. I do not wish to be entirely limited to the use of rubber, although such material is cheap and efficient. However, my mechanism for obtaining discharge of the frozen contents may be applied to pockets of any construction which have a part capable of movement for my purpose.

Now referring to Fig. 2. Each pocket has a portion 36 which in this instance extends above the upper surface of the carrier ring 37. It also has a portion 38 extending below the ring. The bottom portion 38 of the pocket is therefore adapted to be pushed upwardly within the upper portion as shown in Figs. 2 and 3 to a discharge position whereat the cube 39 is ejected and, in

this instance, biased to fall inwardly as best shown in Fig. 3.

The ejected cube falls downwardly into a suitable receptacle 41 such as a pan having a knob 42 by which it can be moved outwardly to accessible position after opening door 45. It will be understood that it is not always necessary to have the part 36 projecting above the top of the carrier. In some embodiments the entire receptacle will be below that level.

I believe my mechanism for moving a portion of any kind of a receptacle to discharge position and returning that portion to an initial full capacity position to be unique. Emptying or discharge of the contents of the cups is accomplished by means of a mechanism which assumes a releasable coupling relation, and which in this embodiment pushes the cup upwardly to discharge position and pulls it downwardly to initial or receiving position, while that coupling relation is maintained. These are positive forceful movements in which the coupling connection is broken only after the receptacle has been restored to full capacity receiving position.

Referring to Fig. 3. A shaft 50 extends from a bracket 51 attached to a vertical wall of the storage chamber. On this shaft is rotatably mounted a kind of wheel 52 having fingers 53, each composed of two spider-like structures connected by a hub, which hub is rotative on shaft 50. The projections or spokes forming each finger are cross-connected by a cylindrical element 55 having its axis parallel with the rotative axis of the wheel or spider structure 52.

Attached to the bottom of each cup, preferably by embedment during moulding of the pocket (see Fig. 4), is a block 60 having a head 61 embedded in the rubber or attached to a movable part of any kind of a suitable cup or pocket. This block has in turn embedded therein a spring clip 62 which is adapted to be engaged by and to clip over one of the cylindrical cross-connecting elements 55 in a manner best shown in Fig. 2. Fig. 4 illustrates one scheme for obtaining ejection of the cube in a desired direction. In this case a discharging bias is given by placing the clip in eccentric relation to the central vertical axis C of the cup 31. It has an outwardly placed eccentricity so as to obtain an inward bias for ejection in the manner shown in Fig. 3.

The degree of tenacity of the gripping action of the clip must be such as to be maintained for drawing the bottom of the empty pocket to its initial position. In order that proper coupling may occur the motions of the carrier and spider frame 53 are synchronized, in this instance by means of a beveled gear 66 meshing with a corresponding circular gear 67 arranged at the bottom of a vertical flange of ring 37 of the carrier.

After coupling has occurred between 55 and 62, continued movement of the synchronized carrier and spider frame moves the portion 38 of the cup to the discharge position shown and then pulls that portion downwardly again to full capacity water-receiving position.

In this form of the device the arrangement is such that groups of three consecutively arranged cups are (at a certain stage in the operation) simultaneously engaged by corresponding parts of the cup-emptying mechanism. Thus, as shown in Fig. 2, while the first and last cup of a given series are in normal (that is, ready for emptying or for receiving) positions, the intermediate cup is in discharge position. For any series in which one cup is at full discharge position, coupling has just

occurred for the first cup of the series and uncoupling is just about to occur for the last or third cup. It is to be understood, however, that other forms of cup-moving devices operating on the same principle may be used.

One phase of this invention concerns the taking advantage of the cohesive action between the inner surface of each pocket and the frozen and/or congealed material therein for holding the movable part of the pocket against motion while a coupling connection of sufficient tenacity is being automatically made and in a manner to assure against premature or accidental uncoupling while pulling force is being applied to move said movable part to initial full-capacity receiving position. Coupling connections must continue until this is accomplished.

To this end, the clips and cylindrical elements of the ejector or wheel (or their functional equivalents) are so designed as to remain securely coupled, and the relations are such that no pocket movement inimical to proper coupling can occur.

After coupling positive thrust force is first applied upwardly for ejection. After ejection there is (in this embodiment) a down pull on the pocket and therefore coupling must be sufficiently secure to be maintained until the pocket has assumed its initial position. As soon as it has assumed this position automatic disconnection takes place against the gripping force of the clip or functionally equivalent means. The clip structure is a specific feature.

By reference to Fig. 1 the reason for having a sliding connection for the coupling means can best be seen. The degree of excursion for any clip 62, and therefore the axial length of a cylinder 55, is related to the chord-like disposition of the arms of the cylinder-carrying wheel in relation to the degree of curvature of the line which is intersected by the vertical axes of the cups and to the relative movements between the pockets and the wheel as they move together in circular paths on axes at right angles to one another. It will be seen that the first cup of a series of three cups travels outwardly from the position of coupling to the ejecting position and then travels inwardly to uncoupling position. Any clip therefore travels outwardly to the position shown for the middle cup and then inwardly, the distance of travel being dependent on the length of the radius of curvature of the line which the axes of the cups intersect. Thus, during simultaneous circular movement of both parts after coupling the clip gradually slides outwardly from one end to the other opposite end of a cylinder. The limits of outward excursion are reached at the point of ejection of the cube and its inwardmost position is at coupling and release points.

After coupling occurs and as the carrier and ejecting wheel continue to rotate, the clips slide along the cylindrical portions of the arms, and thus positive engagement is maintained between the pocket and its ejecting mechanism during upward movement of the pocket to discharge position and lowering movement of the pocket to receiving or initial position.

Means is provided for filling the cups, in this instance with water. There is a water supply pipe 70 having a nozzle 71 properly arranged above the cups of the carrier, as best shown in Fig. 1. Various means may be provided for controlling the flow to properly fill the cups. I have shown mechanical means controlled from the carrier. This means comprises a suitable valve (not shown) which is controlled through a shaft

on which a small spur gear 75 is mounted. Meshing with this small gear 75 is a larger gear 76 operated by a lever 77, the lever in turn controlled by a cam 78 carried by the carrier ring 37. The gear ratios are such as to obtain quick valve operation as a result of small motion of the large gear.

There is a cam provided for each of the cups, properly placed on the carrier so that filling will be properly accomplished during the slow passage of the cup beneath the nozzle 71. The valve is of the automatic closing type and is opened promptly as a result of a very short movement of the lever 77, after said lever is released by the rear part of the cam. For this purpose (see Fig. 5) a suitable spring 79 is provided in relation to the large gear, and this spring causes quick valve closing on release of the lever 77 by any cam 78.

The supply pipe for the nozzle is heavily insulated against cold as shown at 81, and in order to assure against freezing at the delivery orifice of the nozzle, a heating coil 82 is arranged as shown in Fig. 5. The electrical supply wires 83 for the coil run within the insulation to any suitable electrical supply source. The lengths of the cams and their relations to the pockets are such that filling begins as soon as the forward side of the interior of the cup is vertically beneath the center of the nozzle or in water-receiving position, and such that release and automatic valve closure occurs when the opposite or rearward side of the interior of the cup is vertically beneath the center of the nozzle. The water pressure is controlled to prevent undue splashing, preferably by the use of very low pressure, along with a relatively large nozzle orifice.

Although I have described a particular type of valve which is operable for the purpose herein, I do not mean to limit the broader aspects of this invention to this feature. Other types of valves such as electrically controlled valves may be used and suitable contacts provided for closing the circuit to operate the valve at the proper time to open and to keep it open for filling and then close it, before the receptacle moves from a point vertically beneath the nozzle.

The above described structure illustrates one specific means by which filling of the pockets, one at a time, is accomplished. Not all phases of my invention are limited to this specific filling means. It is, of course, conceivable that two or more pockets can be simultaneously filled by a cam-controlled mechanism and by the use of fewer cams by providing a corresponding number of nozzles with valves and by simultaneously operating those valves by a single lever which is cam-controlled. The term "means for automatically filling the pockets or receptacles" is meant to include various other means.

As best shown in Fig. 1, the greater portion of the cup carrier is disposed between suitable refrigerating elements which form a chamber in which the carrier rotates, preferably slowly, to give time for proper freezing. Upper and lower freezing elements are respectively indicated at 85, 86. They are suitably supported on brackets, some of which are attached to the vertical partition element 88 (see Fig. 3), which partition element forms a vertical wall for the compartment 3 adapted to house a suitable refrigeration plant. It will be noted by reference to Fig. 1 that the elements 85 and 86 enclose or cover about ten of the cups. The movement of the carrier and the degree of refrigeration will be

so controlled that freezing will occur while the cups are between the elements 85 and 86. Any suitable refrigerant may be used and the elements 85 and 86 may be filled with it. These elements may have the form of coils. Suitable connections to a suitable refrigerating apparatus (not shown) are had through pipes 89 and 90.

The elements 85 and 86 may represent the expansion chamber or coils of any suitable refrigerating apparatus, and this apparatus is in this case a type used in domestic refrigeration. It will be understood that it may include a compressor with condensing coils and fans for cooling them, along with an expansion valve, all necessary elements being connected with the suction and delivery sides of a suitable compressor. These elements are arranged in the chamber 3 and suitable switches are used for automatically starting and stopping refrigeration, as by a thermostatic control. The coils or expansion elements 85 and 86 may therefore be considered as suitable means for freezing the contents of the cups or pockets.

Another feature of this invention is the manner in which the pocket-carrier is rotatably suspended from the ceiling of the freezing and storage chamber, and the manner in which means, operated from the carrier for automatically emptying the pockets, is supported by a vertical wall of the same chamber. This suspended placement leaves space below the carrier and the ejecting or emptying means for the reception of storage receptacles for frozen cubes and also provides a cold space below the refrigerating elements 85, 86 between which a part of the carrier slowly passes. When the door to the refrigeration and storage chamber is opened, all essential parts can be easily inspected and if need be, adjusted.

As to the details of the cabinet or box in which the present invention is enclosed, any kind of boxing such as ordinarily used in domestic refrigerators may be used. The making of such cold-tight structures is well known in the art and per se forms no part of the present invention, except as providing a suitable freezing and storage chamber, and housing and support for my improved device.

What I claim is:

1. A device of the class described comprising, a rotatable carrier having thereon a pocket having a portion adapted to be moved from a receiving to a discharge position, a rotative member, and means thereon and on said pocket adapted to be coupled and while coupled to move the pocket to discharge position and restore it to receiving position.

2. A device of the class described comprising, a rotatable carrier having thereon pockets having portions adapted to be moved from a receiving to a discharge position, a rotative member and means thereon and on said pockets adapted to couple and then to move the pockets to discharge position and restore them to receiving position.

3. A device of the class described comprising, a rotatable carrier having thereon a pocket having portions adapted to be moved from a receiving to a discharge position, a rotative member having a cylindrical portion, a clip on said pocket, said cylindrical portion and said clip being adapted to couple and then move the pocket portion to discharge position and restore it to receiving position.

4. A device of the class described comprising a freezing chamber, a carrier rotatable within said chamber having thereon pockets having portions

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adapted to be moved from a receiving to a discharge position, a rotative member, and means thereon and on said pockets connectable to move the pockets to discharge position and restore them to receiving position, means synchronizing movements of said carrier and rotatable member for accomplishing the aforesaid functions, and means for filling said pockets with liquid to be frozen.

5. A device of the class described comprising, a freezing chamber, a carrier rotatable within said chamber having thereon pockets having portions adapted to be moved from a receiving to a discharge position, a rotative member, and means thereon and on said pockets cooperable to force the pockets upwardly to discharge position and pull them downwardly to receiving position, means synchronizing movements of said carrier and rotatable member for accomplishing the aforesaid functions, and means for filling said pockets with liquid to be frozen.

6. A device of the class described comprising, a freezing chamber, a rotative carrier therein having a plurality of ice-cube forming pockets of flexible material, a rotatable member, means respectively on the pockets and member adapted to automatically couple and uncouple, means for synchronizing the motions of the carrier and member to cause coupling and then motions of the pockets from initial cube-forming positions to cube-ejecting positions, and then again to initial cube-forming positions, and then release of the coupling means, means for supplying water to the pockets, and means operated by carrier movement for controlling the last mentioned means to supply the proper amount of water to each pocket.

7. A device of the class described comprising, a freezing and cold storage chamber, a rotative carrier ring having passing downwardly there-through a plurality of ice-cube forming pockets of flexible material, a rotatable member below the carrier, means respectively on the pockets and member adapted to automatically couple and uncouple, means for synchronizing the motions of the carrier and member to cause coupling and then upward motions of the pockets from initial cube-forming positions to cube-ejecting positions, and then downward motions to initial cube-forming positions, and then release of the coupling means, means for supplying water to the pockets and means operated by carrier movement for controlling the last mentioned means to supply the proper amount of water to each pocket.

8. A device of the class described comprising, a movable carrier having a plurality of spaced pockets having movable portions, a movable member, said pockets and member having means adapted to be coupled and when coupled adapted to move the pockets from receiving to discharge positions and to return the pockets to receiving positions, and then be uncoupled, and means synchronizing the movements of said carrier and member, the arrangement being such that three of said coupling means can simultaneously remain coupled.

9. A device of the class described comprising, a rotatable carrier having circularly arranged spaced pockets adapted to be separately moved to obtain discharge of their contents, a member rotative on an axis which is perpendicular to the rotative axis of the carrier and having arms, each having a cylindrical element and each pocket having a spring clip adapted for coupling with one of said cylindrical elements and to slide therealong as the rotative member and carrier

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move, and means synchronizing the movement of said carrier and member to cause a cylindrical element to automatically couple with a clip, then move a pocket to a discharge position, then restore the pocket to receiving position and then be disengaged from the clip.

10. A device of the class described comprising, a rotatable carrier having circularly arranged spaced pockets each composed of flexible rubber, a member rotative on an axis which is perpendicular to the rotative axis of the carrier and having arms, each having a cylindrical element and each pocket having a spring clip adapted for coupling with one of said cylindrical elements and to slide therealong as the rotative member and carrier move, and means synchronizing the movement of said carrier and member to cause a cylindrical element to automatically couple with the clip, then move a pocket to a discharge position, then restore the pocket to receiving position and then be disengaged from the clip.

11. A device of the class described comprising, a rotatable carrier having circularly arranged spaced flexible pockets, a rotative member having arms, each having a cylindrical element and each pocket having a spring clip adapted for coupling with one of said cylindrical elements and to slide therealong as the rotative member and carrier move, and means synchronizing the movement of said carrier and member to cause a cylindrical element to automatically couple with the clip, then move a pocket to a discharge position, then restore the pocket to receiving position and then be disengaged from the clip, the arrangement being such that three consecutively arranged pocket clips can be in simultaneous engagement with their corresponding cylindrical elements.

12. A device of the class described comprising, a freezing and cold storage chamber having a ceiling and floor, a carrier rotatably suspended from and supported by said ceiling, said carrier having ice cube pockets thereon, means supported on a vertical wall of said chamber and operated from the carrier for automatically emptying the pockets, and refrigerating elements in said chamber between which a portion of said carrier is moved for refrigerating the contents of the pockets, all of the foregoing elements being spaced above the floor sufficiently to provide a cold storage space for a supply of cubes delivered from the pockets.

13. A device of the class described comprising, a freezing and cold storage chamber having a ceiling and floor, a carrier rotatably suspended from and supported by said ceiling, said carrier having ice cube pockets thereon, means below said carrier and supported on a vertical wall of said chamber and operated from the carrier for automatically emptying the pockets, and refrigerating elements in said chamber between which a portion of said carrier is moved for refrigerating the contents of the pockets, and a door giving access to and permitting inspection of all elements within said chamber.

14. A device of the class described comprising, a freezing and cold storage chamber having a ceiling and floor, a carrier rotatably suspended from and supported by said ceiling, said carrier having ice cube pockets thereon, means supported on a vertical wall of said chamber and operated from the carrier for automatically emptying the pockets, and refrigerating elements in said chamber between which a portion of said carrier is moved for refrigerating the contents of the

pockets, all of the foregoing elements being spaced above the floor for the reception of a receptacle adapted to receive cubes delivered from the pockets, and a door giving access to and permitting inspection of all elements within said chamber, and through which said receptacle is withdrawable.

15. A device of the class described comprising, a horizontal carrier ring secured to the bottom of a vertical shaft, said carrier having a circular row of receptacles arranged marginally thereof, each receptacle having a portion which can move upwardly to eject the contents, said ring having a circular gear rack, an ejector rotatable below the ring on a horizontal axis and driven by the gear-rack and having arms, and means on each arm and on each receptacle adapted to be automatically coupled during motion of the carrier and ejector and while coupled adapted to move said portion of a receptacle from initial to ejecting position and return the same to initial position and then break the coupled connection.

16. A device of the class described comprising, a pocket having a portion movable from a receiving position to eject its contents, ejecting means, means on the pocket and on the ejecting means adapted to be automatically coupled and automatically uncoupled and while coupled adapted to forcibly move the pocket to ejecting position and to forcibly return it to receiving position, and means for automatically operating the ejecting means to successively obtain coupling, ejection, return and uncoupling.

17. A device of the class described comprising, a plurality of pockets each having a portion movable from a receiving position to eject its contents, movable ejecting means adapted to successively act upon the pockets, means on the pockets and on the ejecting means adapted to be automatically coupled and uncoupled and while coupled to forcibly move a pocket portion to eject pocket contents and then forcibly return the pocket portion to receiving position, and means for automatically moving the ejecting means to successively act upon the pockets to cause coupling, ejecting, return and uncoupling.

18. A device of the class described comprising, a pocket made of flexible material so mounted as to adapt its bottom portion to be infolded by upward pressure to eject the contents of the pocket, movable ejecting means adapted to act upon the pocket, means on the pocket and on the ejecting means adapted during motion of the ejecting

means to be automatically coupled and uncoupled and while coupled to forcibly move the pocket to eject its contents and then forcibly return the pocket to receiving position, and means for automatically moving the ejecting means to act upon the pocket to cause coupling, ejecting, return and uncoupling.

19. A device of the class described comprising, a plurality of pockets each made of flexible material so mounted as to adapt its bottom portion to be infolded by upward pressure to eject the contents of the pocket, movable ejecting means adapted to successively act upon the pockets, means on the pockets and on the ejecting means adapted during motion of the ejecting means to be automatically coupled and uncoupled and while coupled to forcibly move a pocket to eject its contents and then forcibly return the pocket to receiving position, and means for automatically moving the ejecting means to successively act upon the pockets to cause return, ejecting and uncoupling.

20. A device of the class described comprising, a plurality of pockets each made of flexible material so mounted as to adapt its bottom portion to be infolded by upward pressure to eject the frozen contents of the pocket, movable ejecting means adapted to successively act upon the pockets, means on the pockets and on the ejecting means adapted during motion of the ejecting means to be automatically coupled and uncoupled and while coupled to forcibly move a pocket to eject its contents and then forcibly return the pocket to receiving position, means for automatically moving the ejecting means to successively act upon the pockets to cause return, ejecting and uncoupling, means for automatically filling the pockets with water and means for freezing the water in the pockets.

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